

## CLAIMS

1. A method of reclaiming a well completion brine comprising the steps of:
  - a. mixing the brine containing metal impurities with an organic chelant for a time sufficient for the chelant to complex a metal,
  - b. the chelant being capable of discriminating between (i) iron and non-zinc heavy metals; and (ii) calcium and zinc; and
  - c. removing the complex metal precipitate from the brine solution.
2. The method of Claim 1, wherein the organic chelant contains up to about 120 carbon atoms and further contains at least one functional group selected from the group consisting of  $-\text{CO}_2\text{H}$  or  $-\text{PO}(\text{OH})\text{R}^{20}$  or a salt or ester thereof,  $-\text{C}(\text{O})-$ ,  $-\text{OE}$ ,  $-\text{SE}$ ,  $-\text{N}=\text{C}(\text{R}^2)\text{R}^3$ ,  $\text{EO}-\text{N}=\text{C}(\text{R}^2)\text{R}^3$ ,  $-\text{N}(\text{R}^2)\text{R}^3$ , and a  $-\text{N}(\text{C}(\text{O})\text{R}^1)\text{R}^2$  group, optionally substituted with a  $-\text{COOH}$  or  $-\text{PO}(\text{OH})\text{R}^{20}$  or a salt or ester thereof or  $-\text{SE}$  or  $-\text{OE}$  group, wherein  $\text{R}^2$  and  $\text{R}^3$  are independently selected from E or forms, with nitrogen, phosphorous, oxygen or sulfur, a heterocyclic ring; E is  $\text{R}^1$  or  $-\text{H}$ ;  $\text{R}^1$  is a  $\text{C}_1$ - $\text{C}_{30}$  alkyl or aralkyl group or a derivative thereof; and  $\text{R}^{20}$  is either  $-\text{OH}$  or  $\text{R}^1$ .
3. The method of Claim 2, wherein the organic chelant is further substituted with at least one group selected from  $-\text{CO}_2\text{H}$  or  $-\text{PO}(\text{OH})\text{R}^{20}$  or a salt or ester thereof,  $-\text{C}(\text{O})-$ ,  $-\text{OE}$ ,  $-\text{SE}$ ,  $-\text{N}=\text{C}(\text{R}^2)\text{R}^3$ ,  $\text{EO}-\text{N}=\text{C}(\text{R}^2)\text{R}^3$ ,  $-\text{P}(\text{R}^2)\text{R}^3$ ,  $-\text{POR}^2\text{R}^3$ ,  $-\text{PO}_3$ ,  $-\text{OPO}_3$ ,  $-\text{SO}_3$ ,  $-\text{OSO}_3$ ,  $-\text{NO}_2$ ,  $-\text{N}(\text{R}^2)\text{R}^3$  or  $-\text{N}(\text{C}(\text{O})\text{R}^1)\text{R}^2$ .
4. The method of Claim 2, further comprising mixing the brine with an oxidizer.
5. The method of Claim 4, wherein the oxidizer is a slow reacting oxidizer.
6. The method of Claim 5, wherein the oxidizer is calcium peroxide or magnesium peroxide.

7. The method of Claim 6, wherein the organic chelant is benzoic acid or a salt or ester thereof.

8. The method of Claim 2, wherein the functional group is  $-\text{COOH}$  or a salt or ester thereof.

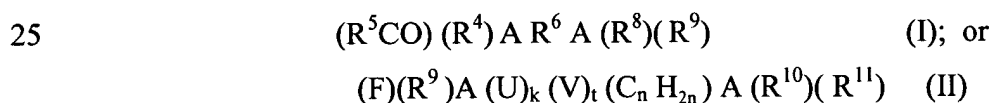
9. The method of Claim 8, wherein the organic chelant is benzoic acid or a salt or ester thereof.

10. The method of Claim 8, wherein the organic chelant is further substituted with at least one group selected from  $-\text{OE}$ ,  $-\text{SE}$ ,  $-\text{P}(\text{R}^2)\text{R}^3$ ,  $-\text{POR}^2\text{R}^3$ ,  $-\text{PO}_3$ ,  $-\text{OPO}_3$ ,  $-\text{SO}_3$ ,  $-\text{OSO}_3$ ,  $-\text{NO}_2$ ,  $-\text{N}=\text{C}(\text{R}^2)\text{R}^3$ ,  $\text{EO}-\text{N}=\text{C}(\text{R}^2)\text{R}^3$ ,  $-\text{N}(\text{R}^2)\text{R}^3$ ,  $-\text{N}(\text{CH}_2)_2$  and  $-\text{N}(\text{C}(\text{O})\text{R}^1)\text{R}^2$  optionally substituted with a  $-\text{COOH}$  or  $-\text{PO}(\text{OH})\text{R}^{20}$  group or a salt or ester thereof or with an  $-\text{OE}$  or  $-\text{SE}$  group.

11. The method of Claim 10, wherein the organic chelant further contains the functional group  $-\text{NR}^2\text{R}^3$  optionally substituted with a  $-\text{COOH}$  or  $-\text{PO}(\text{OH})\text{R}^{20}$  group or a salt or ester thereof or with an  $-\text{OE}$  or  $-\text{SE}$  group.

12. The method of Claim 11, wherein the organic chelant is nitrilotriacetic acid or a salt or ester thereof.

13. The method of Claim 10, wherein the organic chelant is an ethylene diamine type of the structural formula:



or a derivative thereof

wherein A is nitrogen or phosphorus;  $\text{R}^4$ ,  $\text{R}^8$ ,  $\text{R}^9$ ,  $\text{R}^{10}$  and  $\text{R}^{11}$  are independently  $-(\text{CH}_2)_x\text{COOH}$  or  $-(\text{CH}_2)_x\text{PO}(\text{OH})\text{R}^{20}$  or a salt or ester thereof,  $-(\text{CH}_2)_x\text{OE}$ ,  $(\text{CH}_2)_s\text{SE}$  or  $\text{R}^5\text{C}(\text{O})-$  or a derivative thereof;  $\text{R}^5$  is  $-\text{H}$  or a  $\text{C}_1$ - $\text{C}_{30}$  alkyl or aralkyl group or derivative thereof;  $\text{R}^6$  is  $\text{C}_n\text{H}_{2n}$  or a derivative thereof;  $\text{R}^{14}$  is  $\text{R}^5$  or  $\text{R}^8$ ; F is  $-(\text{CH}_2)_x\text{COOH}$  or -

$(\text{CH}_2)_x\text{PO}(\text{OH})\text{R}^{20}$  or a salt or ester thereof,  $-\text{OE}$ ,  $-\text{SE}$ ,  $-(\text{CH}_2)_x\text{SE}$  or  $-(\text{CH}_2)_x\text{OE}$  or a derivative thereof;  $\text{U}$  is  $-(\text{CH}_2\text{CONR}^5)_z$ ;  $\text{V}$  is  $-(\text{C}_n\text{H}_{2n}\text{AR}^8-)$ ;  $n$  is 1 to 15;  $x$  is 1 to 4; and  $k$ ,  $z$  and  $t$  are independently 0 to 2.

5 14. The method of Claim 13, wherein the organic chelant is selected from the group consisting of ethylene diamine tetra acetic acid; hydroxyethylenediamine triacetic;  $\text{O}$ ,  $\text{O}'$ -bis(2-aminoethyl) ethyleneglycol- $\text{N}, \text{N}, \text{N}', \text{N}'$ -tetraacetic acid;  $\text{N}$ -(glycylglycyl)-1,2-diaminoethane- $\text{N}', \text{N}', \text{N}'', \text{N}''$ -tetraacetic acid; and  $\text{N}$ -(2-hydroxyethyl) ethylenediaminetriacetic acid or a salt or ester thereof.

10

15. The method of Claim 8, wherein the organic chelant further contains the functional group  $-\text{N}(\text{COR}^1)\text{R}^2$  group optionally substituted with a  $-\text{COOH}$  or  $-\text{PO}(\text{OH})\text{R}^{20}$  group or a salt or ester thereof or with an  $-\text{OE}$  or  $\text{SE}$  group.

15 16. The method of Claim 15, wherein the organic chelant is  $\text{N}$ -acyl ethylenediaminetriacetic acid or a salt or ester thereof.

17. The method of Claim 16, wherein the organic chelant is  $\text{N}$ -lauroyl ethylenediaminetriacetic acid or a salt or ester thereof.

20

18. The method of Claim 15, wherein the organic chelant contains from ten to one hundred twenty carbon atoms.

19. The method of Claim 18, wherein the organic chelant contains a counter ion  
25 selected from the group consisting of ionic forms of sodium, potassium, cesium, ammonium, monoethanolamine, diethanolamine, triethanolamine,  $\text{N}$ -propylamine, isopropylamine, 2-amino-2-methyl-1,3-propane diol, 2-amino-2-methyl-1-propanol, 2-amino-2-ethyl-1,3-propane diol, tris(hydroxymethyl) aminomethane, group II metals, and a Group 3-7 transition metal.

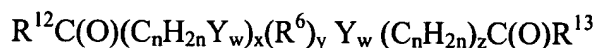
30

20. The method of Claim 8, wherein the organic chelant is substituted with at least one -OE, -SE, -POR<sup>2</sup>R<sup>3</sup>, -PO<sub>3</sub>, -OPO<sub>3</sub>, -SO<sub>3</sub>, or -OSO<sub>3</sub> group.
21. The method of Claim 20, wherein the organic chelant is substituted with an -OE group.
22. The method of Claim 21, wherein the organic chelant is N-(2-hydroxyethyl)ethylenediaminetriacetic acid or a salt or ester thereof or zinc di-(12-hydroxy-9-octadecenoate).
23. The method of Claim 8, wherein the organic chelant is substituted with a -P(R<sup>2</sup>)R<sup>3</sup> or -POR<sup>2</sup>R<sup>3</sup> group.
24. The method of Claim 15 wherein the organic chelant is selected from the group consisting of acyl glutamic acid; N-lauroyl glutamic acid; acyl sarcosinic acid; and N-lauroyl sarcosinic acid and salts thereof.
25. The method of Claim 23, wherein the organic chelant is of the formula (HOOCCH<sub>2</sub>)<sub>2</sub>PCH<sub>2</sub>CH<sub>2</sub>P(CH<sub>2</sub>COOH)<sub>2</sub> or a salt or ester thereof.
26. The method of Claim 8, wherein the organic chelant is selected from the group consisting of benzoic acid; benzene-1,2-dicarboxylic acid; benzene-1,3,5-tricarboxylic acid; nonyl-1,3-dicarboxylic acid; and 1-hydroxy-2-napthoic acid and salts thereof.
27. The method of Claim 2, wherein the organic chelant contains at least one -N(R<sup>2</sup>)R<sup>3</sup>, -N=C(R<sup>2</sup>)R<sup>3</sup>, EO-N=C(R<sup>2</sup>)R<sup>3</sup> or a -N(C(O)R<sup>1</sup>)R<sup>2</sup> group wherein R<sup>2</sup> and R<sup>3</sup> independently may be substituted with a -COOH, -PO(OH)R<sup>20</sup>, -SE or -OE group or a salt or ester thereof.
28. The method of Claim 27, wherein the organic chelant is N,N'-dimethyl-N,N'-dilauroylethylenediamine or a salt thereof.

29. The method of Claim 27, wherein the organic chelant is 1, 2-diaminobenzene or a salt thereof.
- 5 30. The method of Claim 27, wherein the organic chelant is iminobis (methylenephosphonic acid) or a salt or ester thereof.
31. The method of Claim 27, wherein the organic chelant is further substituted with at least one group selected from -OE, -SE, -PO<sub>3</sub>, -OPO<sub>3</sub>, -SO<sub>3</sub>, -OSO<sub>3</sub>, or -NO<sub>2</sub>.
- 10 32. The method of Claim 31, wherein the organic chelant is substituted with an -OE group.
33. The method of Claim 32, wherein the organic chelant is 8-hydroxy quinoline or a salt thereof.
- 15 34. The method of Claim 32, wherein the organic chelant is substituted with a -SO<sub>3</sub> or a -OSO<sub>3</sub> group.
- 20 35. The method of Claim 27, wherein the organic chelant is substituted with a -SO<sub>3</sub> or a -OSO<sub>3</sub> group.
36. The method of Claim 35, wherein the organic chelant is 1-aminobenzene-2-sulfonic acid or a salt thereof.
- 25 37. The method of Claim 27, wherein the organic chelant is a nitrogen, phosphorous, oxygen or sulfur containing heterocyclic ring.
38. The method of Claim 37, wherein the organic chelant is porphine or derivatives thereof or salts thereof.
- 30

39. The method of Claim 27, wherein the organic chelant is selected from the group consisting of 1,2-dimethylethylenedinitrilotetraacetic acid; DL-1-alkylethylenedinitrilotetraacetic acid N,N'-diamide; 1,2-dimethylethylenedinitrilotetraacetic acid N,N'-diamide; 1,2-phenylenedinitrilotetraacetic acid; N-(cyclohexyl)iminodiacetic acid; acyl glutamic acid; acyl sarcosinic acid; N,N-dimethyl-2-aminophenol; 4-phenyl-8-mercaptoquinoline; and N-lauroylethylenediaminetriacetic acid; and salts thereof.
40. The method of Claim 39, wherein the organic chelant is selected from the group consisting of ethylenediaminetetraacetic acid and N-lauroylethylenediaminetriacetic acid; and salts thereof.
41. The method of Claim 2, wherein the functional group is -OE or -SE.
42. The method of Claim 41, wherein the organic chelant is N-hydroxy-N-nitrosobenzenamine or a salt thereof.
43. The method of Claim 41, wherein the organic chelant further contains at least one group selected from -PO<sub>3</sub>, -OPO<sub>3</sub>, -SO<sub>3</sub>, -OSO<sub>3</sub>, or -NO<sub>2</sub>.
44. The method of Claim 43, wherein the organic chelant contains a -SO<sub>3</sub> or -OSO<sub>3</sub> group.
45. The method of Claim 44, wherein the organic chelant is 1-hydroxybenzene-2-sulfonic acid or a salt thereof.
46. The method of Claim 41, wherein the organic chelant contains a -PO<sub>3</sub> or -OPO<sub>3</sub> group.
47. The method of Claim 43, wherein the organic chelant is 4-nitro-1,2-dihydroxybenzene or a salt thereof.

48. The method of Claim 2, wherein the organic chelant is a diketone having the structural formula:



5 or derivative thereof

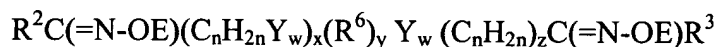
wherein  $R^{12}$  and  $R^{13}$  are independently -H or a  $C_1$ - $C_{30}$  alkyl or aralkyl group optionally substituted with a -COOH or -PO(OH) $R^{20}$  or a salt or ester thereof, -N( $R^2$ ) $R^3$ , -SE or -OE group;  $R^6$  is  $C_nH_{2n}$  or a derivative thereof; Y is -O, -S, -P or -N; n is 1 to 30, w is 0 or 1, and x, y and z are independently 0 to 5.

10

49. The method of Claim 48, wherein the organic chelant is pentane-2,4-dione or octadecane-2,4-dione.

50. The method of Claim 3, wherein the organic chelant is a dioxime having the structural formula:

15



or a derivative thereof;

wherein  $R^2$  and  $R^3$  are independently selected from  $R^1$ , -(CH<sub>2</sub>)<sub>s</sub>OE, -(CH<sub>2</sub>)<sub>s</sub>SE or -(CH<sub>2</sub>)<sub>s</sub>COOH or -(CH<sub>2</sub>)<sub>s</sub>PO(OH) $R^{20}$  or a salt or ester thereof;  $R^1$  is -H or a  $C_1$ - $C_{30}$  alkyl or aralkyl group or derivative thereof;  $R^6$  is  $C_nH_{2n}$  or a derivative thereof; E is  $R^1$  or -H; Y is -O, -S, -P or -N; s is 1 to 4, n is 0 to 5, w is 0 or 1 and x, y and z are independently 0 to 5.

20

51. The method of Claim 50, wherein the organic chelant is 2,3-butanedionedioxime.

25

52. The method of Claim 1, further comprising mixing the brine with an oxidizer.

53. The method of Claim 52, wherein the oxidizer is a slow reacting oxidizer.

54. The method of Claim 1, further comprising adding to the brine an absorbent or defoamer in an amount sufficient to reduce the level of foaming caused by uncomplexed organic chelant.
- 5 55. The method of Claim 54, wherein the absorbent is activated carbon.
56. The method of Claim 55, wherein the organic chelant is N-lauroyl ethylenediaminetriacetic acid or a salt or ester thereof.
- 10 57. The method of Claim 52, further comprising adding to the brine an absorbent or defoamer in an amount sufficient to reduce the level of foaming caused by uncomplexed organic chelant.